

1 1. (Thrice Amended) A method for detecting a threshold temperature in an
2 integrated circuit comprising the steps of:
3 generating a voltage reference that is substantially independent of a
4 temperature of the integrated circuit;
5 receiving at least one programmable input specifying a value
6 corresponding to a threshold temperature for the integrated circuit;
7 generating a sensing voltage that varies substantially linearly with the
8 temperature of the integrated circuit;
9 scaling the sensing voltage in accordance with the value to generate a
10 comparison voltage, wherein the comparison voltage is substantially equal to
11 the voltage reference when the temperature of the integrated circuit is
12 substantially the same as the threshold temperature; and
13 generating a signal when a difference between the comparison voltage
14 and the voltage reference indicates the integrated circuit has attained said
15 threshold temperature.
16 [generating a voltage reference that is substantially constant over a
17 range of temperatures of said integrated circuit;
18 receiving at least one programmable input that specifies a threshold
19 temperature for said integrated circuit;
20 generating a sensing voltage wherein said sensing voltage amplitude
21 exhibits a substantially linear relationship with said temperature of said
22 integrated circuit;
23 generating a scale factor based on said programmable input;

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24 scaling said sensing voltage based on said scaling factor to generate a
25 comparison voltage such that when said integrated circuit attains said
26 threshold temperature said comparison voltage is substantially equal to said
27 voltage reference;
28 comparing said voltage reference to said comparison voltage; and
29 generating a signal when said comparison voltage exceeds said voltage
30 reference to indicate said integrated circuit temperature attained said
31 threshold temperature.]

1 2. (Twice Amended) The method of claim 1 wherein the step of generating
2 the voltage reference further comprises the step of generating a silicon
3 bandgap voltage reference. [as claimed in claim 1 further comprising the step
4 of programming a threshold temperature by specifying said programmable
5 input.]

1 3. (Twice Amended) The method of claim 1 wherein the step of generating
2 the sensing voltage further comprises the step of generating a base-to-emitter
3 voltage (V_{be}) from a bipolar transistor. [as claimed in claim 2 wherein:
4 the step of generating a constant voltage reference comprises the step
5 of generating a silicon bandgap voltage reference; and
6 the step of generating a sensing voltage comprises the step of
7 generating a base to emitter voltage (V_{be}) from a bipolar transistor.]

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1 4. (Twice Amended) The method of claim 3 wherein the step of scaling the
2 sensing voltage further comprises the step of selecting a bias of the bipolar
3 transistor in accordance with the value.
4 [as claimed in claim 3 wherein the step of scaling said sensing voltage
5 comprises the step of providing a plurality of resistive elements, wherein a
6 first resistive element is coupled from the base to the collector of said bipolar
7 transistor, and a second resistive element is coupled from the base of said
8 bipolar transistor to ground, wherein said first resistive element and said
9 second resistive element generate a scale factor for scaling said sensing
10 voltage.]

1 5. (Twice Amended) The method of claim 4 further comprising the steps of:
2 providing a first resistive element coupled to a base and a collector of
3 the bipolar transistor;
4 providing a plurality of series coupled resistors to form a second
5 resistive element coupled to the base and an emitter of the bipolar transistor;
6 and
7 shorting a combination of the plurality of series-coupled resistors in
8 accordance with the value to select the bias of the bipolar transistor.
9 [as claimed in claim 4 wherein the step of programming a threshold
10 temperature by specifying a scale factor comprises the steps of:
11 coupling a plurality of resistors in series to generate said second
12 resistive element;

13 coupling, across each resistor in said second resistive element, a
14 transistor; and
15 selectively biasing each transistor so as to select a combination of said
16 resistors in said second resistive element to specify said scale factor for scaling
17 said sensing voltage.]

1 6. (Twice Amended) The method as claimed in claim 5 wherein [said] the
2 plurality of resistors comprises a plurality of binary weighted resistors.

1 7. (Twice Amended) The method as claimed in claim 1 wherein [said] the
2 integrated circuit comprises a microprocessor.

1 8. (Thrice Amended) An apparatus for detecting a threshold temperature in
2 an integrated circuit comprising:

3 voltage reference means for generating a voltage reference substantially
4 independent of a temperature of the integrated circuit;

5 at least one programmable input for receiving a value corresponding to
6 a threshold temperature of the integrated circuit;

7 temperature sensing means for generating a sensing voltage wherein
8 the sensing voltage varies substantially linearly with the temperature of the
9 integrated circuit, the temperature sensing means scaling the sensing voltage
10 in accordance with the value to generate a comparison voltage, wherein the
11 comparison voltage is substantially equal to the voltage reference when the
12 integrated circuit attains the threshold temperature; and

13 comparison means coupled to the temperature sensing means and the
14 voltage reference means, wherein the comparison means generates a signal
15 when the comparison voltage exceeds the voltage reference to indicate the
16 integrated circuit temperature attained the threshold temperature.

17 [voltage reference means for generating a voltage reference that is
18 substantially constant over a range of temperatures of said integrated circuit;
19 at least one programmable input for receiving a threshold temperature
20 for said integrated circuit;

21 temperature sensing means for generating a sensing voltage wherein
22 said sensing voltage amplitude exhibits a substantially linear relationship
23 with said temperature of said integrated circuit, said temperature sensing
24 means including scaling means generating a scale factor based on said
25 programmable input and for scaling said sensing voltage in accordance with
26 said scale factor to generate a comparison voltage such that when said
27 integrated circuit attains said threshold temperature said comparison voltage
28 is substantially equal to said voltage reference; and

29 comparison means coupled to said temperature sensing means and
30 said voltage reference means for comparing said voltage reference to said
31 comparison voltage, and for generating a signal when said comparison
32 voltage exceeds said voltage reference to indicate said integrated circuit
33 temperature attained said threshold temperature.]

1 9. (Twice Amended) The apparatus of claim 8 wherein the voltage reference
2 is a silicon bandgap voltage reference. [The apparatus as claimed in claim 8
3 further comprising programming means for programming a threshold

4 temperature by specifying said programmable input a scale factor for scaling
5 said sensing voltage.]

1 10. (Twice Amended) The apparatus of claim 8 wherein the temperature
2 sensing means further comprises a bipolar transistor for generating a
3 base-to-emitter voltage as the sensing voltage.

4 [The apparatus as claimed in claim 9 wherein:

5 said voltage reference means generates a silicon bandgap voltage
6 reference; and

7 said temperature sensing means comprises a bipolar transistor for
8 generating a base to emitter voltage (V_{be}) for said sensing voltage.]

1 11. (Twice Amended) The apparatus as claimed in claim 10 further
2 comprising a plurality of resistive elements, wherein a first resistive element
3 is coupled from a base to a collector of the bipolar transistor, and a second
4 resistive element is coupled from the base of said bipolar transistor to an
5 emitter of the bipolar transistor. [wherein said scaling means comprises a
6 plurality of resistive elements, wherein a first resistive element is coupled
7 from the base to the collector of said bipolar transistor, and a second resistive
8 element is coupled from the base of said bipolar transistor to ground, wherein
9 said first resistive element and said second resistive element generate a scale
10 factor for scaling said sensing voltage.]

1 12. (Twice Amended) The apparatus of claim 11 wherein the second resistive
2 element comprises a plurality of series-coupled resistors, wherein at least one

3 transistor is coupled across each of some of the plurality of resistors, wherein
4 a combination of the resistors is selected in accordance with the value.

5 [The apparatus as claimed in claim 11 wherein:

6 said second resistive element comprises at least one resistor;

7 said programming means comprises:

8 at least one transistor coupled across each resistor in said second

9 resistive element; and

10 biasing means for biasing each transistor so as to select a combination
11 of said resistors in said second resistive element to specify said scale factor for
12 scaling said sensing voltage.]

1 13. (Twice Amended) The apparatus [as claimed in 11 wherein said] of claim
2 11 wherein the resistors comprise a plurality of binary weighted resistors.

1 14. (Twice Amended) The apparatus [as claimed in 8 wherein said] of claim 8
2 wherein the integrated circuit comprises a microprocessor.

1 15. (Twice Amended) An apparatus for detecting a threshold temperature in
2 an integrated circuit comprising:

3 a bandgap reference circuit providing a voltage reference substantially
4 independent of a temperature of the integrated circuit;

5 a bipolar transistor providing a base-to-emitter voltage (Vbe) as a
6 sensing voltage, wherein the sensing voltage varies substantially linearly
7 with the temperature of the integrated circuit;

8 at least one programmable input receiving a value corresponding to a
9 threshold temperature for the integrated circuit;
10 a voltage divider coupled to the bipolar transistor, wherein the voltage
11 divider scales V_{be} in accordance with the value to generate a comparison
12 voltage, wherein the comparison voltage is substantially equal to the voltage
13 reference when the temperature of the integrated circuit is substantially equal
14 to the threshold temperature; and
15 a comparator providing a signal when a difference between the
16 comparison voltage and the voltage reference indicates that the threshold
17 temperature has been attained.

18 [a silicon bandgap reference circuit that generates a silicon bandgap
19 voltage reference, wherein said silicon bandgap voltage reference is
20 substantially constant over a range of temperatures of said integrated circuit;

21 a bipolar transistor wherein a base to emitter voltage (V_{be}) from said
22 bipolar transistor generates a temperature sensing voltage of said integrated
23 circuit;

24 at least one programmable input that receives a threshold temperature
25 for said integrated circuit;

26 a voltage divider circuit coupled to said bipolar transistor that scales
27 said V_{be} to generate a comparison voltage such that when said integrated
28 circuit attains said threshold temperature, said comparison voltage is
29 substantially equal to said silicon bandgap voltage; and

30 a comparator coupled to said collector of said bipolar transistor and to
31 said voltage reference circuit that compares said silicon bandgap voltage to
32 said comparison voltage, and that generates a signal when said comparison

33 voltage exceeds said silicon bandgap voltage to indicate said integrated circuit
34 temperature attained said threshold temperature.]

1 16. (Twice Amended) The apparatus of claim 15 wherein the voltage divider
2 comprises a first resistive element coupled from a base to a collector of the
3 bipolar transistor and a second resistive element coupled from the base to an
4 emitter of the bipolar transistor. [as claimed in claim 15 wherein said voltage
5 divider circuit comprises a plurality of resistive elements, wherein a first
6 resistive element is coupled from the base to the collector of said bipolar
7 transistor, and a second resistive element is coupled from the base of said
8 bipolar transistor to ground, wherein said first resistive element and said
9 second resistive element generate a scale factor for scaling said V_{be} .]

1 17. (Twice Amended) The apparatus of claim 16 further comprising:
2 _____ a plurality of series-coupled resistors forming the second resistive
3 element; and
4 _____ a plurality of transistors, at least one of each of the plurality of
5 transistors coupled across one of the plurality of resistors, wherein the
6 plurality of transistors select a combination of resistors in accordance with the
7 value to provide a bias voltage for the bipolar transistor.
8 [The apparatus as claimed in claim 16 further comprising:
9 a plurality of resistors for said second resistive element;
10 a plurality of transistors coupled in parallel with each resistor; and

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11 a plurality of programming voltages input to said transistors for biasing
12 said transistors so as to select a combination of said resistors in said second
13 resistive element to specify said scale factor for scaling said sensing voltage.]

1 18. (Twice Amended) The apparatus [as claimed in 16 wherein said] of claim
2 16 resistors comprise a plurality of binary weighted resistors.

1 19. (Twice Amended) The apparatus [as claimed in 15 wherein said] of claim
2 15 wherein the integrated circuit comprises a microprocessor.

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